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Tactile Painting Easel: For people with limited vision

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TACTILE PAINTING EASEL

for people with limited vision

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Thesis

Master of Fine Art in Industrial Design

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Abstract

Visual art is probably the oldest art. But people with vision challenges have been held back, perhaps for many years by avoiding making art. However, it is never late to start and this painting system helps to paint with ease and joy. Through the researching about the behavior of people with visual disability, the conclusions are: Painting can help people with limited vision to face life in a more positive way; vision and touch are closely related. After the shape symbolism experiment and interview, the conclusion is people with visual disability understand the metaphors of the pictures. The mock blind life experience shows that people with visual disability have heightened other senses. After the attempts of blind drawing, the problems came out and the design goals are help people with visual disability draw accurate position and size, recognize colors and set up the supplies independent. The outcome is a painting system that allows people who are blind or who have limited vision to draw, while also allowing people with sight to see what is being drawn. The user simply presses the raised guideline and uses tactile guide points to draw. The easel also features a folding, latching storage drawers and a textured palette with for mixing pigments, a sink, and cleaning foam. The brushes with convenient textured tags in their handles, allow one to identify the shape of brushes. The six basic color pigments are scented, which helps to recognize them by smell, on top of braille labels. The raised guide arrows can be touched everywhere in the box for tactile reference and guidance.

Key words: blind, design, visual disability, painting, easel

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Introduction

Visions of the what happens:

the common desire of people with vision limited

Because painting is very much a visual medium to create art and state obvious, having sight is significant when it comes to working as a painter. It is easy to imagine how blindness would end the dream of becoming a painter. People with different abilities have unique needs for education and recreation than those who are physically typical. Whether it is work, study, daily living or social activities, people with physical challenges need to overcome many obstacles in life. If there are opportunities for entertainment, such as painting, they can reduce spirit of tension and become soothing.

It is often said that, the heart's letter is read in the eyes or the eyes are the window to the soul. But if the window was closed forever? All the people with vision disability we have seen are walking carefully with crutches step by step. And for others who have a pair of bright eyes can clearly see the beautiful colors of nature, but it is difficult for the blind to do this. In the eyes of the blind, the world seems to always be dark, not a little light and beautiful. To keep normal life, they just can feel the nature through the touch, smell and hearing. Many people will complain about the world is not fair when they encounter the difficulties and inability to solve things, they will ask why not their circumstances can be more smoothly? But for the blind, the world's balance is never tilted to them.

The sage said, the heart of loving beauty exists everywhere. Factually, arts itself does not have any boundary or definition. Any person may become an artist. The blind as a special group of the population, they have the same yearning for art. And a group of recognized blind painter also produced in the world, like Michael Williams, Hal Lasko, John Bramblitt, Esref Armagan, Sargy Mann, etc. they have declared war on the limit of humans. Therefore, the

blind pursuit of the art of painting is very common and worthy of attention. There are 285 million people are estimated to be visually impaired in the world: 39 million are blind and 246 million have low vision. (World Health Organization, 2014) Economic development and policy improvement allow blind came out from poverty and solve the problem of survival. Thereupon, many blind people began to pursue the art of painting, not to be overlooked is that they do have the passion, inspiration, talent and ability to paint. If they give up the art of painting, then the world will lose a lot of good artists. People with visual disabilities have a much more urgent need for education and recreation than those who are physically fitness. Whether it is work, study, daily living or social activities, the blind need to break through more difficulties and obstacles than ordinary people. If there are opportunities for entertainment, such as painting, can make their spirit of tension be soothing.

Problems

But, why almost no people with limited vision are willing to paint? The simple answer is art painting is a visual activity, but they have visual disabilities. Specifically, there are too many factors will encounter them to give up in the process of painting. Before painting, they need a process to set up the supplies, basically are paper, easel, paints and brushes. When started painting, the problems are not only don't know how to draw, but also need to keep use these supplies interchangeably. Of course, if there is someone with health sight can help them on the side, that must be easier, but people with visual disability feel alone and usually have trouble in making new friends. Compared to their sighted peers, people with visual disability have lower self-esteem, social skills, and academic achievement resulting in a need for being supported in psychosocial aspects. (Huurre, T. M., and H. M. Aro. "Psychosocial development among adolescents with visual impairment." *European Child & Adolescent Psychiatry* 7, no. 2 (1998): 73-78.)

It can be seen a product designed for blind painting at least need to meet the requirement that let the people with visual disability take care of themselves without rely on other people to help. Moreover, reduce the failure rate and improve the self-confidence also need to be considered.

Research

Painting can help people with limited vision to face life in a more positive way.

Art has been an important part of John Bramblitt's life, but until he completely lost his vision, everything changed. From the age of 11, John Bramblitt's vision gradually degenerated due to epilepsy, until he was 30 years old, has been completely blind, no longer see the color, so he entered what he called the "deepest, darkest hole". But John Bramblitt decided to make a change at the lowest point in his life. After a full year of blindness, he decided to return to the embrace of color. He began to learn how to paint without sight. "It wasn't until a year after going blind that I began to figure out a way to be able to draw again" (Bored Panda, 2015) He used a fabric to be paint base, utilized the way of touching the raised edge to find the direction of painting. Works that were previously finished in 14 hours can now be completed faster. Visual failure, instead of focusing more easily, his work becomes bold, lifelike - he used this way to show their perception of color and shape to the outside world. He drew a huge number of amazing paintings with the continuous practice and trying. He even said that different colors of paint have different tactility in the hands, like "white is thicker like toothpaste, and black is thinner. "(All That is Interesting, 2015) loss of vision, but get a more powerful sense of touch. John's paintings are all use bright colors without exception, as if he shouted to the dark. Although many of his paintings originate from an observation experience before blindness, he can also paint with things he has never seen, such as his wife and son. For the blindness, he reads this way: "In a way, I am glad that I became blind," Bramblitt muses. "This makes more sense when you stop thinking about adversity as an obstacle, and start viewing it as an experience—something that you can learn from and grow from." (All That is Interesting, 2015) Such optimistic thoughts, we believed John Bramblitt's dark world is also colorful.

Vision and touch are closely related

John M. Kennedy, completed his Ph.D. in perception at Cornell University and began his research with the blind shortly thereafter as an assistant professor at Harvard University. He concludes that raised line pictures for the blind are as well-known as Braille texts soon and blind so readily appreciate line drawings and other graphic symbols. in the very early phase of his study, john did a simple experiment that whether blind people can recognize the facial profiles just draw with outline. the purpose of this attempt was to figure out the sensitivity

Figure 1

that blind people touching the outline and whether blind people can understand the meaning of the outline even if they never see these in the real world. The subjects of this attempt are three men and six women. Four were congenitally blind, three had lost their sight after the age of three, and two had minimal vision. The subjects were asked to describe each display using one of four labels: smile, curly hair, beard or large nose. On average, the group described 2.8 of the four displays accurately,



showing that blind people often recognize the outline of simple objects. (Figure1) (John M Kennedy,1997)

John showed us these process and results of his experiments about blind people drawing and found out the principles of how blind people draw pictures. His purpose of these experiments is to find out if other blind people could readily make useful illustrations— and if

these drawings would be anything like the pictures sighted individuals use. John hoped to discover whether the blind could interpret the symbols commonly used by sighted people.

(John M Kennedy,1997)

John indicated that the blind has considerable innate pictorial abilities. In addition, these abilities can be boosted by captions, another boost might be a code for removing ambiguity

from a picture. He emphasized that we must draw attention immediately is the practical application of these drawings. (John M Kennedy, 1983)

Amedeo D'Angiulli (Department of Psychology, University of Toronto, Ontario), John M. Kennedy (Department of Psychology, University of Toronto, Ontario) and Morton A Helle (Winston-Salem State University, North Carolina) argue blind and sighted children use the same principles to identify the pictures, but the blind have superior exploration skills. To test this theory, authors asked blind children (aged 8–13) and blindfolded age-matched sighted children to identify raised-line drawings of common objects. The result showed that their performances were correlated.

People with visual disability understand the metaphors of the pictures

From the studies described above, blind people can appreciate the use of outlines and perspective to describe the arrangement of objects and other surfaces in space. But pictures are more than literal representations. Moreover, I wanted to discover whether there were differences in how the blind and the sighted interpreted lines of motion. I explored how well blind people understand the symbolism behind shapes, which do not directly represent their meaning. I gave a list of 20 pairs of words to 10 children that with limited vision in a Chinese blind school and asked them to pick from each pair the term that best related to a circle and the term that best related to a square. For example, I asked: What goes with soft? A circle or a square? Which shape goes with hard? All our subjects deemed the circle soft and the square hard. Thus, I concluded that the blind interprets abstract shapes as sighted people do.

(Figure 2)

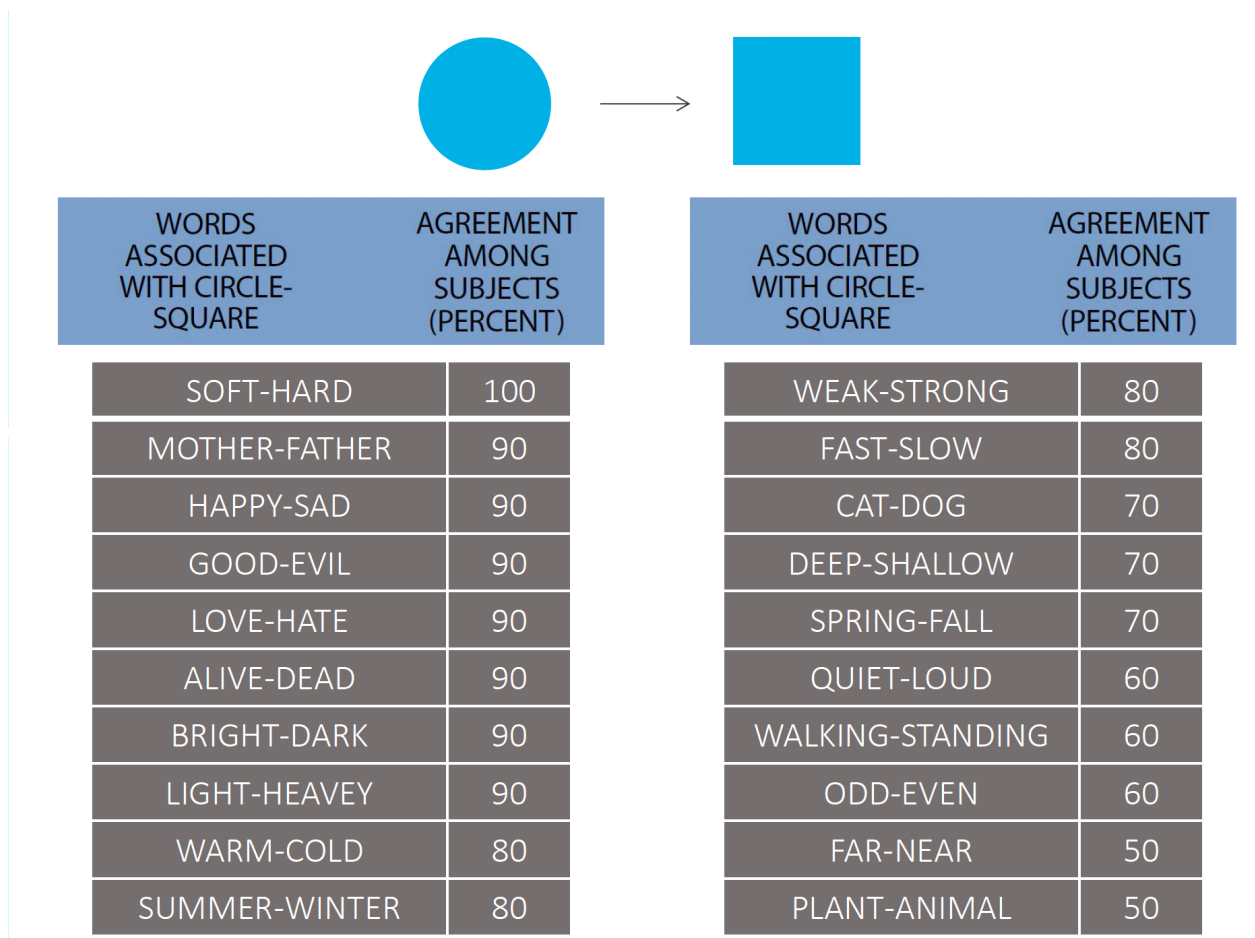


Figure 2

Does people with visual disability have heightened senses?

When I search “blind” on social media like Facebook and twitter, people always ask to discuss the questions such as because blind people are blind that their other senses would be heightened, Like some special ability. So, I planned to be a blind for several days to verify the truth of these thoughts. And see what I notice because I think if I take I am out of the equation I really do believe that I’ll start to notice a lot of things going on around me that I don’t need to see to understand or to hear or to smell or to touch. To get a more accurate feeling and answer, I was blindfolded for three days, three hours each day. And started to record my feeling on third day.

When I bring the blindfold, the first feel was just curious about the unknown things.

However, this mood suddenly disappeared accompanied by changes in my position. the dark in front of my eyes, the confusion of direction, so that I real to become a tender blind. I hear things that you might not notice like the sounds of the fridge turning on or off. I mean, it's not like I can tell people what kind of shirt they're wearing by the sound you make but I can hear they put their jacket on. Just in different conversations I can hear all sorts of things that are happening with people. With my sense of touch, I notice things that people probably see. I can tell what my clothes are by maybe the buttons, or something on the collar, or a tag, or the seam. There is all kind of little clues in clothing. So, I can find all my favorite outfits and put them on. So, as a result I've been forced to learn thing that sighted people just don't know or even pay attention to. Smell is interesting because again I'm not distracted. I'm not watching things so I must use my nose. So maybe I'll smell that something is dirty or something's gone wrong in the garbage and I should go find it and figure what that is and get rid it. I can smell when people walk by me by the cologne or the perfume or even if somebody's a little dirty.

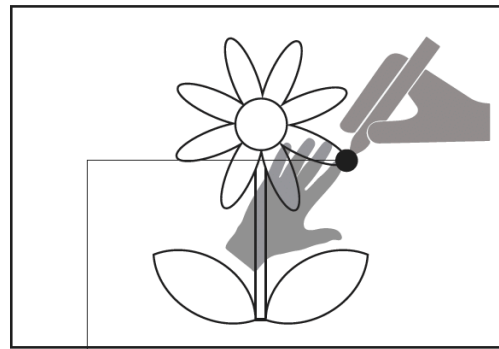
These experiences give me an inspiration that people see pictures by sight because they should or they have been told this is right way. Ordinary pictures are visual representations of referents from the real world or of an artist's or designer's imagination. Therefore, they are of no use for people without vision. This is what common sense might tell us. And this is where "common sense" is wrong. The most important characteristic of a picture is not its channel of perception (visual or non-visual), but the method of arranging information in space. This is, in most cases, the 2D space: the plane, of paper or canvas. The spatial arrangement and depiction of objects carries information about the real world arrangement of the depicted objects or about other relationships between these objects. It can be perceived visually or tactually or even sometimes acoustically.

The problems within the blind drawing

The difficulties of blind drawing are reflected in various details and actions, which we can't even imagine. Multiple blind painting experiments are required. First time, I tried to draw a lunch box. When I put on the blindfold, I can only rely on my left hand to explore the paper under the pen, when I feel the outline of it, I started draw on paper. I want to draw some sushi, it should have black-purple laver cover, white rice and red fish meat. According to the composition of a picture in my mind, then I had no idea the rest of lunch box should be in what position. I can't see what I painted, I was a little worried about the location, the size is correct or not. But when I took off the blindfold, I found that these worries were superfluous. I barely painted anything on paper, because I did not dip enough paint.

After more attempt, my paintings with my eyes closed posed many problems for me. Can't return to point of beginning, can't draw my desired size, can't draw in accurate position. Whenever I did painting, I ended up with empty space on the canvas. I discovered the problem of empty space while watching the video I took of my blind painting. A visually handicapped person can't feel a brush as he senses his fingers. To locate where to draw, and measure the distance, must need hands and fingers cooperation (Figure3). if I just use hand to draw, without my fingers to touch the canvas, the results are not good, like deviation, out of bounds, out of shape and no references (Figure4).

To locate where to draw, and measure the distance, must need **two hands** cooperation. It is no possible use one hand to do that.



If need draw something at this point

1. one hand touch this point
2. other hand hold brush and find where is first hand
3. start with this point and draw

Figure 3

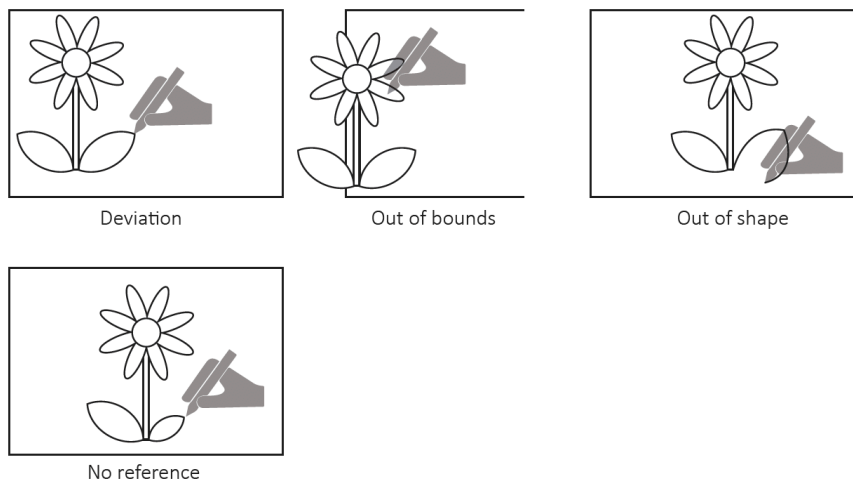


Figure 4

Once end the previous stage of drawings (pen/brush leaves paper), it is difficult locate where is previous drawings. If it not the continuous drawing, I can't spot the end of previous drawings. So, I can't determine where to start next drawings. This is will result in mistakes in next stage of drawings (Figure5). If I previous drawings can't be perceived, my drawings will be resulted malposition, overlap, not of uniform size and needless duplication (Figure6). Same as above, choosing colors, bring many problems. The location/sequence of the desired color can't / difficult be determined. I discussed the issue of color with respect to the visually

impaired. how should I recognize colors? My way is to number the colors in numbers. For instance, white = 1, yellow = 2, lemon = 3, orange = 4, and so on. Thus, most of the colors will be communicated.

But I always waste too many time on choose the right color that let me give up many times, even choose the wrong color. I can't determine the amount of color, the paints always run out when drawing not finish, can't draw the required depth of color. In the drawing process, paints always contaminate each other and make the hands and paper dirty. Proportion also can't be specified in palette (Figure7).

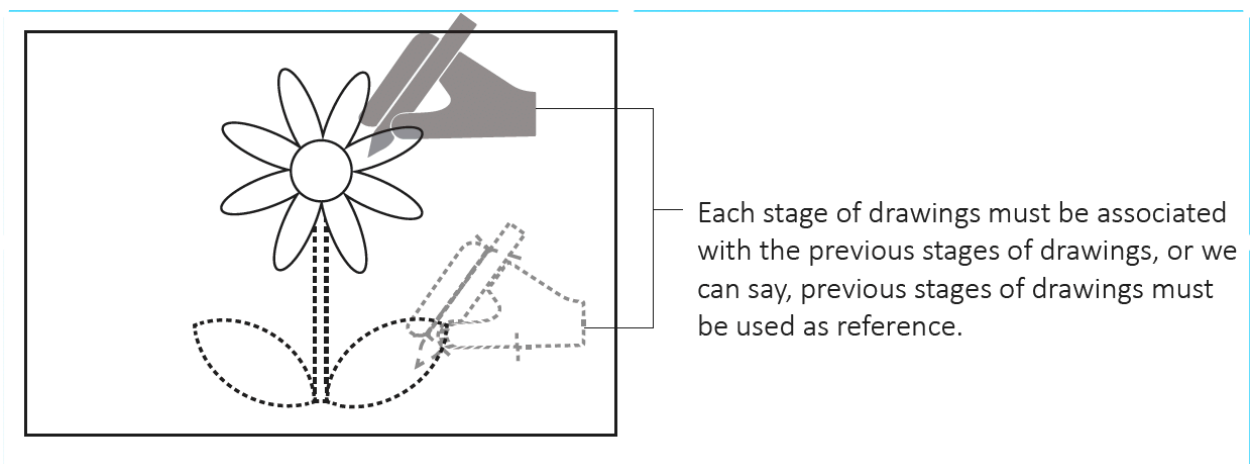


Figure 5

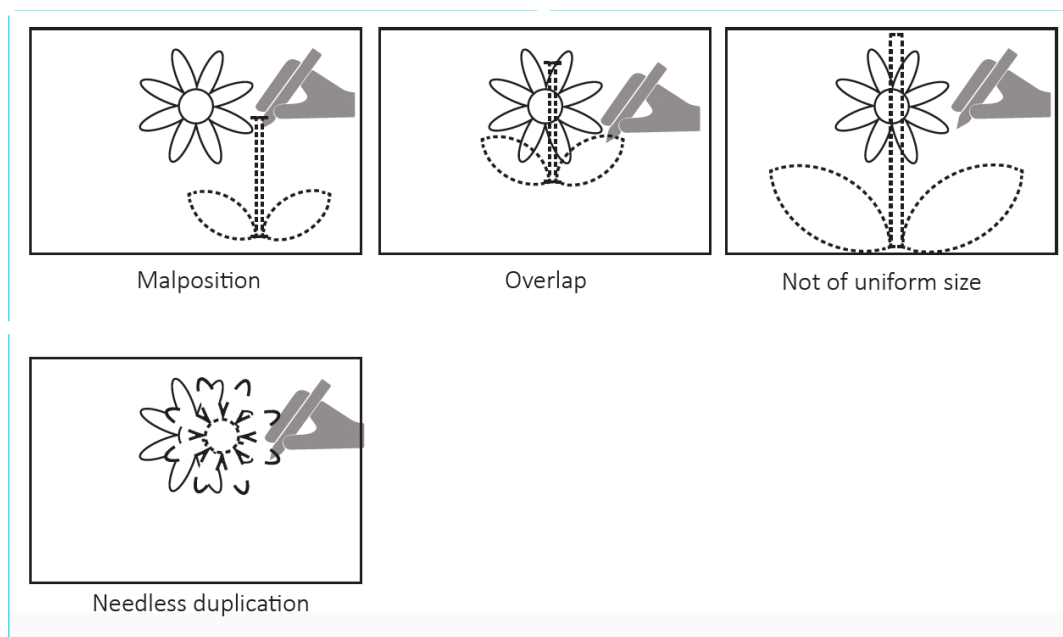


Figure 6

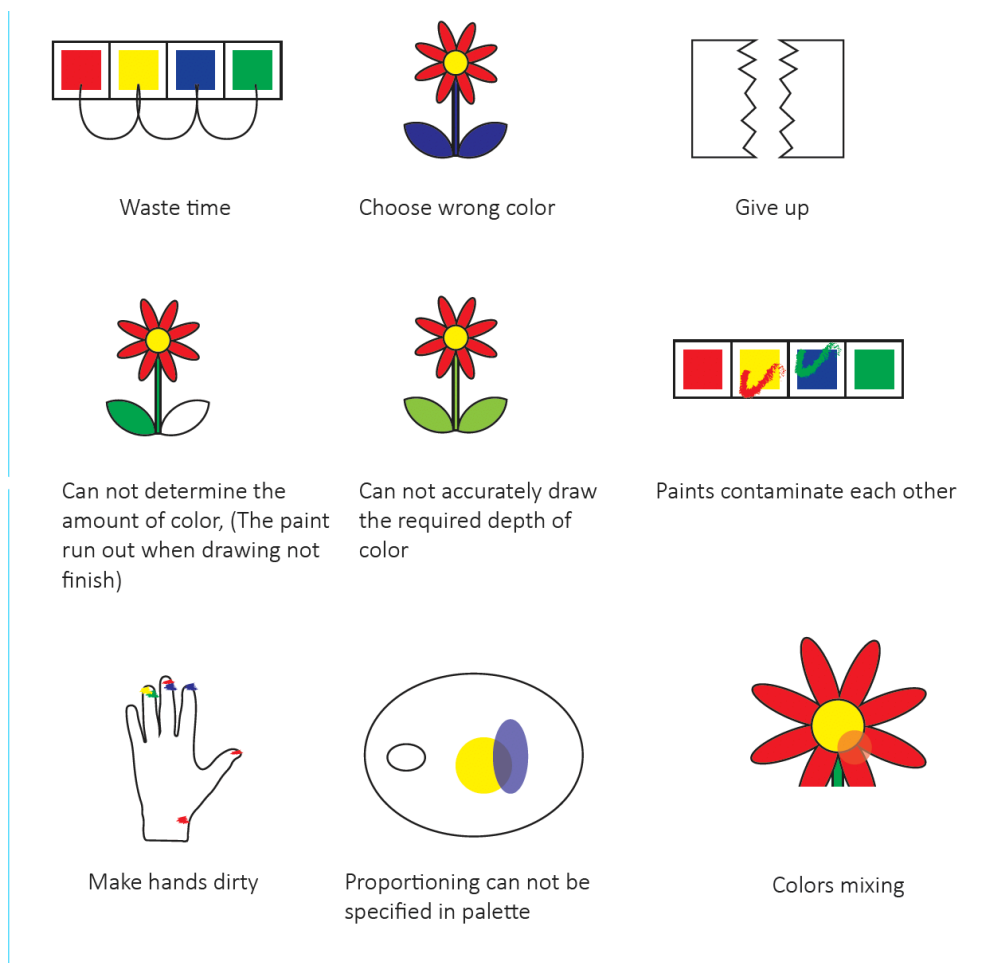
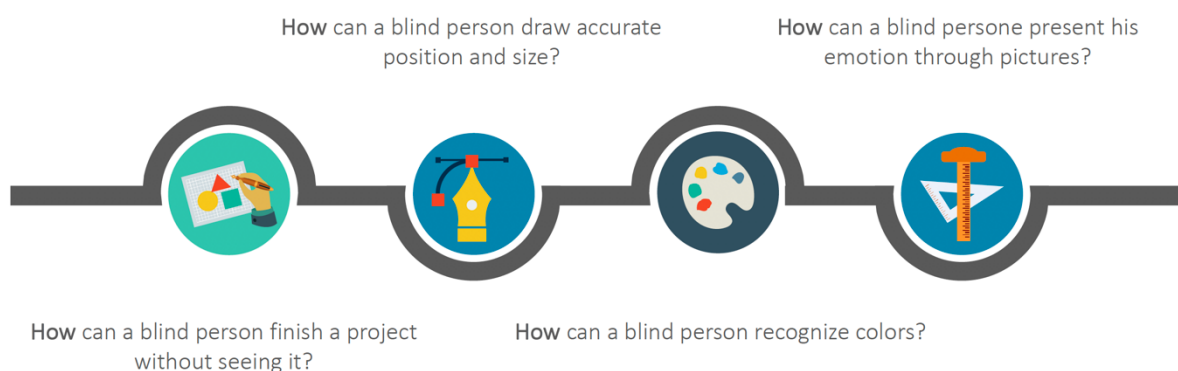


Figure 7



And also some tools need to be invented to help the blind develop their skills smoothly.

Figure 8 Design points

Design Process

In the next phase, I Combined with the existing blind drawing methods and the problems I found in previous testing, I tried some solutions that I thought might be helpful such as with solid paints, with raised outlines, drawing with fingers. And I summarize the advantages and disadvantages of these methods (Figure9).


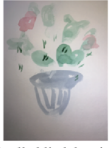



	Contour Accuracy	Proportions/Distances	Color Accuracy	Color Diversity	Light and shadow	Details
 Signed drawing	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
 Totally blind drawing	● ○ ○ ○ ○	● ○ ○ ○ ○	● ● ○ ○ ○	● ○ ○ ○ ○	● ○ ○ ○ ○	● ○ ○ ○ ○
 Blind drawing with raised outline	● ● ○ ○ ○	● ● ○ ○ ○	● ● ● ● ○	● ● ● ○ ○	● ● ○ ○ ○	● ● ○ ○ ○
 Blind drawing with solid paints	● ● ● ● ○	● ● ● ● ○	● ● ● ○ ○	● ● ● ● ○	● ● ● ● ○	● ● ● ○ ○
 Blind drawing with fingers	● ● ○ ○ ○	● ● ● ○ ○	● ● ● ○ ○	● ● ● ○ ○	● ● ○ ○ ○	● ● ○ ○ ○

Figure 9

I also tried to use nature things to draw the cactus, I used tree skin in flowerpot and use grass in cactus, and plastic crystal in flower. It is fun but will make trouble, just for fun in one time that people won't like to do this often (Figure10-11).



Figure 10

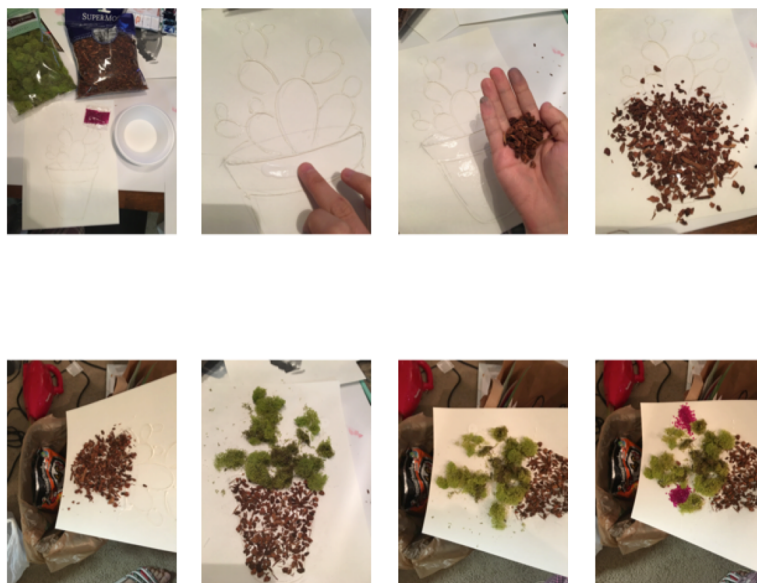


Figure 11

Ideations

First sketch (Figure12) delivers the idea of using other sensory except sight to help drawing. Blind can identify which brush they need depend on sound from different number of ring balls. It also can choose the correct color through touching the texture on the top of

paints box. The sketch with a board on the wall and an easel (Figure13) is to describe the concept that blind need a painting board or easel to make painting process more convenient. This board or easel can contain all the materials and allow blind can get it and organize it easily. Each season generally has colors, shapes, and objects associated with it. A summer theme might teach concepts about water and animals that live in the water, round sand dollars and star-shaped fish, the colors blue, green, yellow and white, gritty sand and fuzzy beach towels, one fish and many fish. The last sketch (Figure14) reflects the idea of theme box, each box has a specific theme and contain materials related to this theme. Blind will use these materials to draw the pictures about this theme.

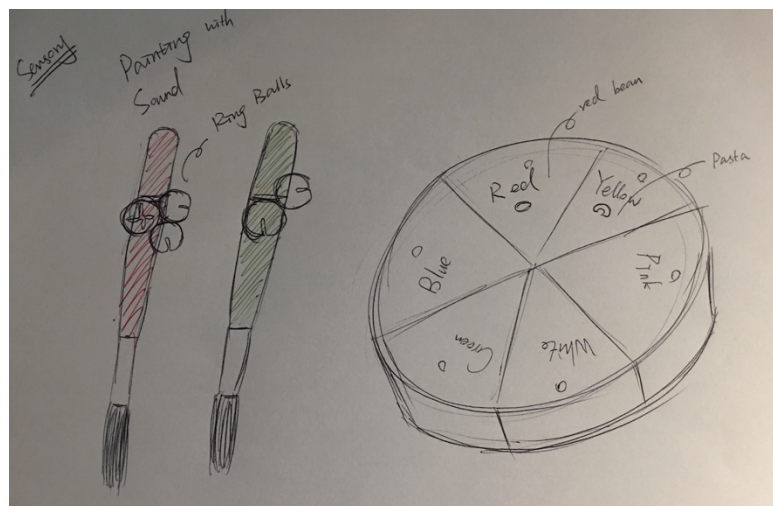


Figure 12

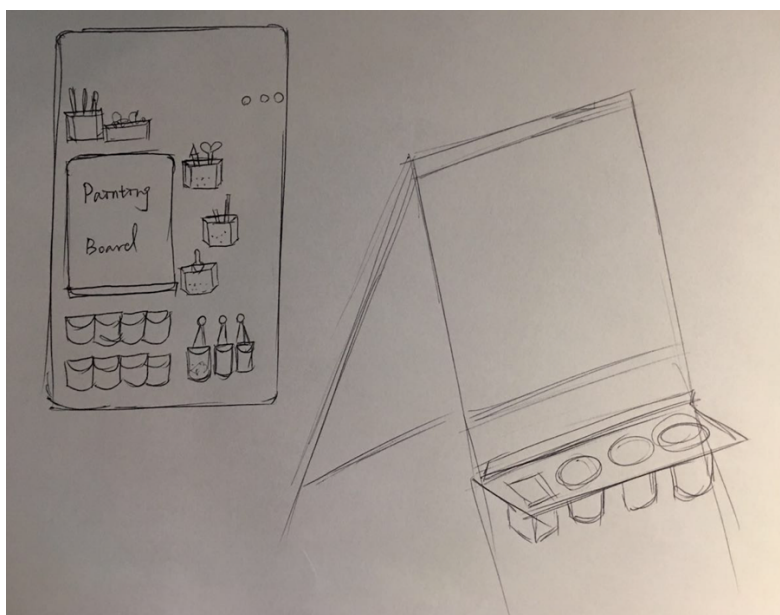


Figure 13

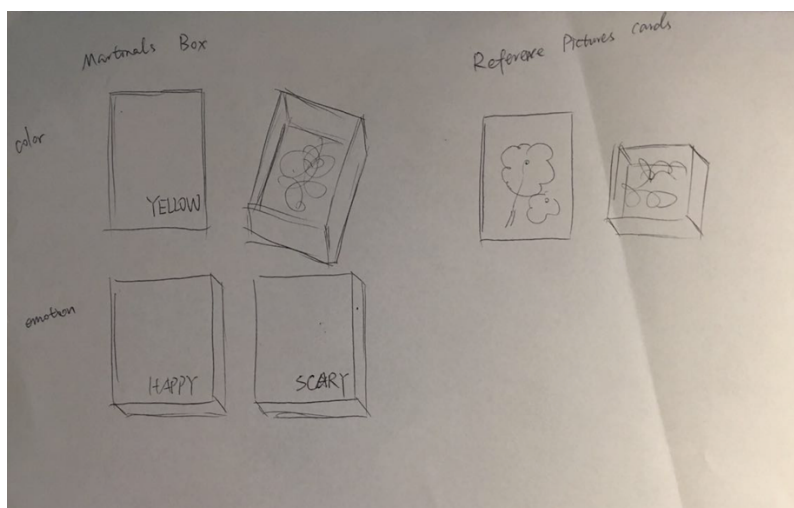


Figure 14

Design Methodology

A reference board to help blind can draw items in accurate position and size, also can know where is previous drawings (Figure15). The first phase of this reference board is design to help blind determine where to draw on paper and the size in advance. The initial concept is there are two sticks on the board can help positioning and commit size. Adjust the sticks to

measure where to draw and how big to draw, use needle and string to mark the end of previous drawings (Figure15). To helping blind draw more easily, I would like to have a painting box with more functions. I add an adjustable incline magnetic surface on the top of box, not only to stick papers, also can stick painting tools. I keep reference board marking needle, and change it to two simply sticks that can stick on the magnetic surface. There will be a drawer in the box that can contain materials (Figure16). But after testing, this concept was abandoned because it is too complex to blind people. The sticks always get dirty because the brush can't be controlled when I close my eyes. My painting experience was serious obstructed by these sticks (Figure17).

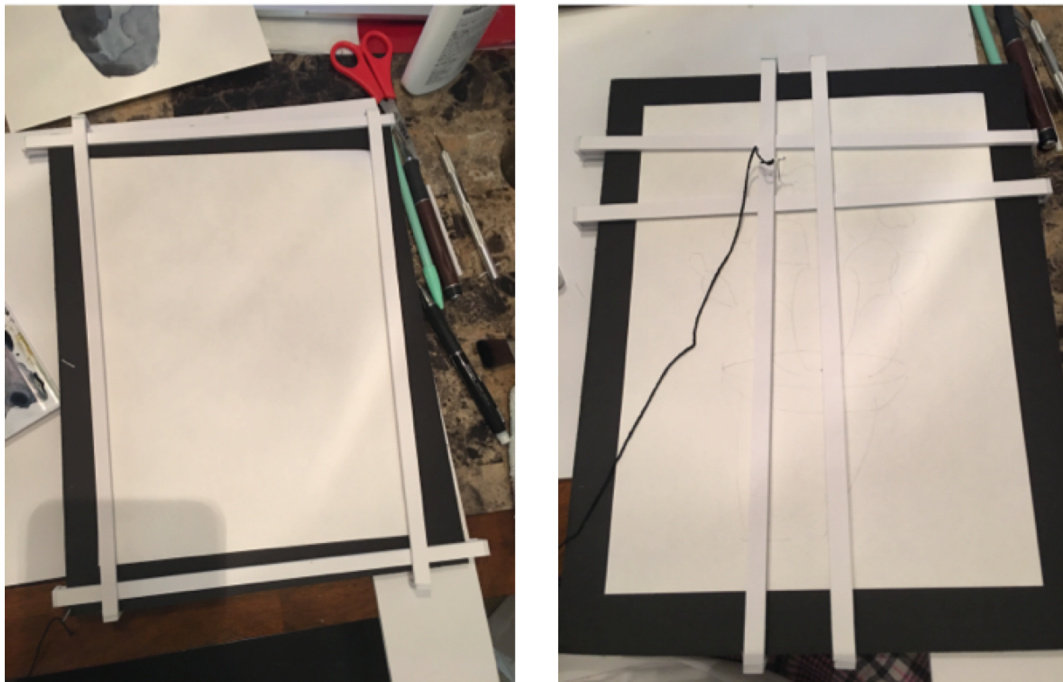


Figure 15



Figure 16



Figure 17

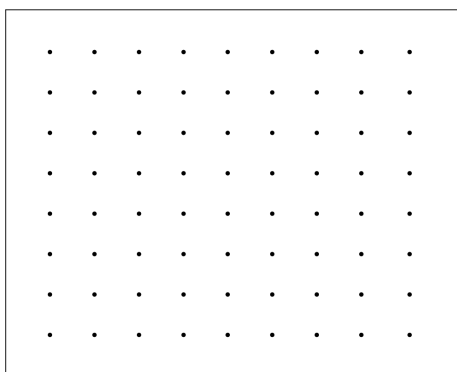


Figure 18

Braille is a tactile writing system that used by people with visual limited and it is consisted of points. So, I use braille to be a main element in my design of textured background board. When users ready to draw a picture, a sheet is held over a textured background board, providing a tactile reference for setting up the

right orientation and size of paper and supporting it with a frame. The user simply presses the

tactile guide points to draw. There are 72 raised points on the center of the board that can clearly touch through the paper sheet, users touch these points like a space lattice (Figure18).

To help blind choose correct color, I would like to add nature items related to the color on the top of paints and add scents into paints (Figure19). Blind can identify color by touching and smelling, also can add scents on their pictures (Figure20). To achieve it, I add the scents grains in paints.



Figure 19



Figure 20

Conceptual Experimental Testing

Asked 8 participants with blindfold to use the box, without any prompt. Let them just use touch to figure out how to open the box and drawer, install paper, find supplies and draw specific objects. The main problem was: The points can't be touched very clear through Paper; Points under the paper hinder drawing process; Wash the brush; Support stick's direction always confused users; The fixation of the paper is not strong; The box always move when touch the board; The hole on the bottom of drawer let her want to open the drawer in vertical direction; When release the support stick, the stick will go down automatically, but it need to go up to close the box. (Figure 21-22)

For the final design, the changes I need to do are: Put the reference points around the paper, instead of under the paper; change the raised points in the center of board to sunk points that won't hinder the drawing process; Reduce the number of colors; Make deference brush with deferent shape, or put the recognize texture on the body of brush; Change the design of palette, through add raised lines on it, and function of wash the brush; Reverse the direction of support stick, change it go up to close; The painting board should have deferent material with other parts in the box to let users recognize it easily; Add rubber under the box to fix the box; Change the gridded points to coordinate axis; Increase the height of the box, there should be a gap between the box and the desktop.

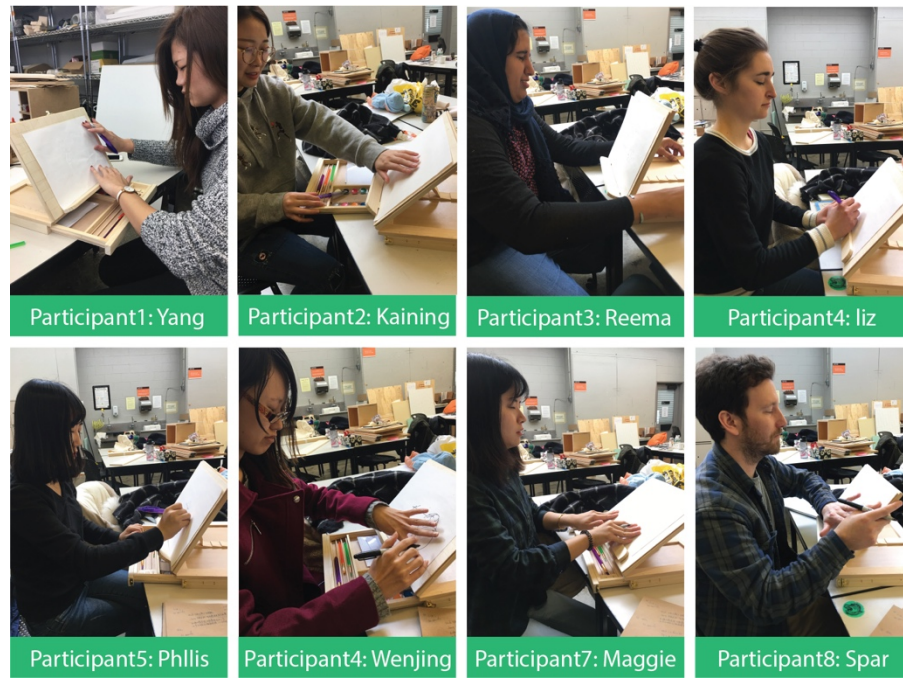


Figure 21

	Open the box and find supplies	Feel reference points clearly	Reference points are helpful
1	<1min	● ● ● ● ●	● ● ● ● ●
2	Failed	● ● ● ● ●	● ● ● ● ●
3	<1min	● ● ● ● ●	● ● ● ● ●
4	<30sec	● ● ● ● ●	● ● ● ● ●
5	<30sec	● ● ● ● ●	● ● ● ● ●
6	<2min	● ● ● ● ●	● ● ● ● ●
7	20sec	● ● ● ● ●	● ● ● ● ●
8	20sec	● ● ● ● ●	● ● ● ● ●

Figure 22

Final Design: Tactile Painting Easel for People with Limited Vision

A painting system that allows people who are blind or who have limited vision to draw, while also allowing people with sight to see what is being drawn. (Figure23)



Figure 23

Textured background board

Braille is a tactile writing system that used by people with visual limited and it is consisted of points. So, I use braille to be a main element in my design of textured background board. When users ready to draw a picture, a sheet is held over a textured background board,

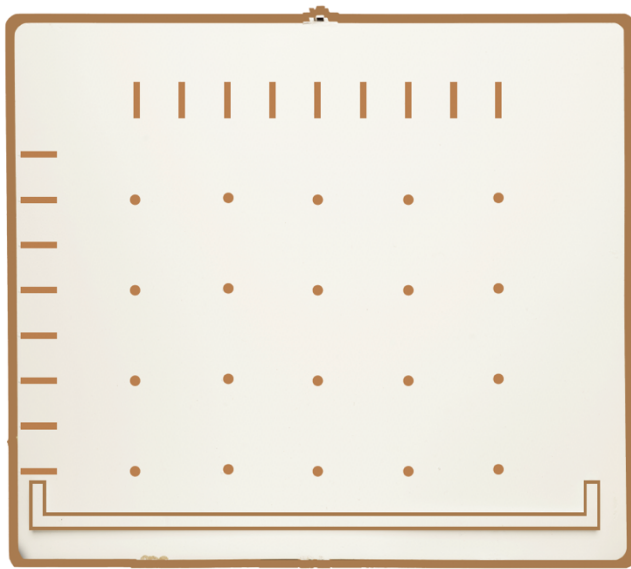


Figure 24

providing a tactile reference for setting up the right orientation and size of paper and supporting it with a frame. The user simply presses the raised guideline and uses tactile guide points to draw. There are 20 raised points on the center of the board that can clearly touch through the paper sheet, users touch these points like a space lattice. Also, on the top side and left side, the two-dimensional coordinate consisted of raised short lines help user recognize the location increasingly (Figure24).

Storage drawers with blind friendly supplies



Figure 25

The easel also features a folding, latching storage drawers, users get the information of where is the drawer and how to open it through the raised guide arrows (Figure25). Once drawer is opened, users can find

all the supplies through touching. The drawer also can be a brush rack that use to hold the brushes. The brushes with convenient textured tags in their handles, allow one to identify the shape of brushes (Figure26). The six basic color pigments are scented, which helps to recognize them by smell, on top of braille labels. When user start painting, user touch the textured tags choose the brush and touch the braille choose the color,



Figure 26

then user use the textured palette to mix the colors, there six small units to put the single color and three big units use to mixing colors. The textured guide arrows between small units and big units that can help user find the route to mix colors, and the textured symbols in the big units help user differentiating. The sink under the palette also can be found through the textured guide arrows, and it is easy to take out and put in, to refill water (Figure28). After wash the brush, user can find the cleaning foam under the pigments to dry it (Figure27). The scents in the pigments give each color a unique emotion, when painting is finished, user smell the paper to feel the mixing emotion of the picture.

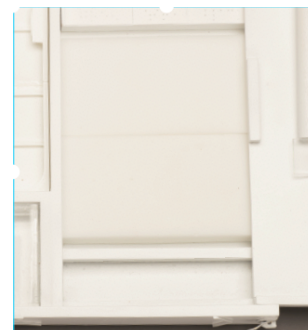


Figure 27

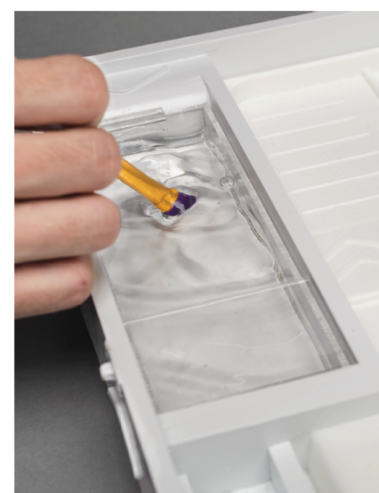


Figure 28

Testing Report

I brought the easel to Nanjing Blindman School to do testing with the blind students. First day, I did a brief introduction to students. I told them the principle of the textured background. I didn't mention how to use the supplies to keep a little imagination for them. Then I asked them to use the easel to draw anything they want, they really enjoyed it and draw a lot of beautiful pictures (Figure 29-33). Next day, I asked 12 students to use the easel to draw a human hand and record the feedbacks(Figure 34). What I didn't think of was a girl

named Jiaman(Figure35) told me she think people human nails are like leaves, she wants to decorate her “hand” with a few leaves. I was surprised by her imagination, and I asked other students to do the same thing. Finally, we got 12 fantastic paintings(Figure 36).



Figure 29



Figure 30

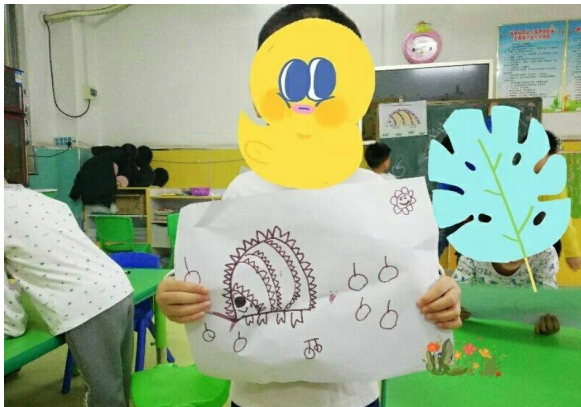


Figure 31



Figure 32



Figure 33

Open the box and find supplies	Feel reference points clearly	Reference points are helpful	Supplies Problems
<1min	• • • • •	• • • • •	the brushes are difficult to control
<2min	• • • • •	• • • • •	can't take palette out
<1min	• • • • •	• • • • •	difficult to get the pigments
<1min	• • • • •	• • • • •	get the wrong color
<30sec	• • • • •	• • • • •	good
<2min	• • • • •	• • • • •	difficult to get the pigments, get easel dirty
<30sec	• • • • •	• • • • •	easy to get dirty by pigments
<30sec	• • • • •	• • • • •	crayon will be better
<1min	• • • • •	• • • • •	difficult to get the pigments
<2min	• • • • •	• • • • •	get too much pigments
<30sec	• • • • •	• • • • •	good
<2min	• • • • •	• • • • •	don't like water color

Figure 34



Figure 35



Figure 36

Conclusion

To the improvement. I will add the painting methods not just watercolor also crayon or color pensile to make the painting process easier. Chang the material to be more light and cheap budget.

This thesis argues that blind people absolutely can paint. Painting not only relies on visual experience, tactile also plays an important role. Even if the blind lack of visual experience, as long as the full use of other sensory functions, they also can develop good painting skills.

Blind have the same painting development trend with sighted people, but its development is lagging behind; Not only that, graphic painting can also be used as a blind communication with others in a non-verbal way.

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